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Review Article

Bombay Blood Group: A Distinct Descent

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ABSTRACT

In the field of medical sciences, the Bombay blood group (oh/hh) is a rare yet evolving entity. The 'oh' blood group has distinct genotype and phenotype characteristics. This article explores the dynamics involved in the Bombay blood group, presenting its epidemiology, phenotype, genotype, biochemistry distribution, clinical manifestations and management.

Key Words *- Bombay blood group, Phenotype, Genotype, hh blood group*

INTRODUCTION

Blood, a connective tissue is inevitable for human existence. It is vital to save the lives of patients. The blood components are very expensive and rare as its process and storage is limited due to its short viability. In spite of this being rare, improper matching of blood group has always been one of the leading causes of blood transfusion related mortality. Blood group as per the encyclopedia of Genetics, 2008 is defined as the basis of chemical present on the surface of blood cells which are involved in cell recognition. A particular blood group (blood types) dictates the presence or absence of antigens inherited from either parent onto the surface of red blood cells.

So far, 36 blood group substances are recognized by the International society for blood transfusion. The most common are ABO and Rh which help in determining an individual's blood group and to match the compatibility for blood transfusion. But the real challenges lie in identifying the rare blood group among human population and intervene promptly for their survival in times of need.

DEFINITION

The Bombay blood group is a rare blood group which is characterized by the absence of A, B and H antigens in the red blood cell surfaces. It is known as the hh blood group or the" Oh" blood group. [(2)]

HISTORICAL BACKGROUND

It was first discovered by Dr. Y.M. Bhende C. K. Deshpande and H.M Bhaia of the Seth gordhandas Sunderdas Medical College in Bombay (Mumbai) in 1952 who first spelt it as Bombay. [(1)] Thus, it is called as the Bombay Blood group.

THE 'H' ANTIGEN

Karl Landsteiner in his discovery of the famous ABO blood types identified that the red blood cells have an "H" antigen on their cell surfaces.

This H antigen is the precursor of A & B antigens. This H antigen is modified into "A" or "B" antigen like wise and the individual get either "A" ,"B" or "AB" blood group. This modification occurs in the presence of a Transferase Enzyme. If this enzyme is lacking, then the "H "antigen is not modified and these individuals have the "O" blood group. [(5-7)]

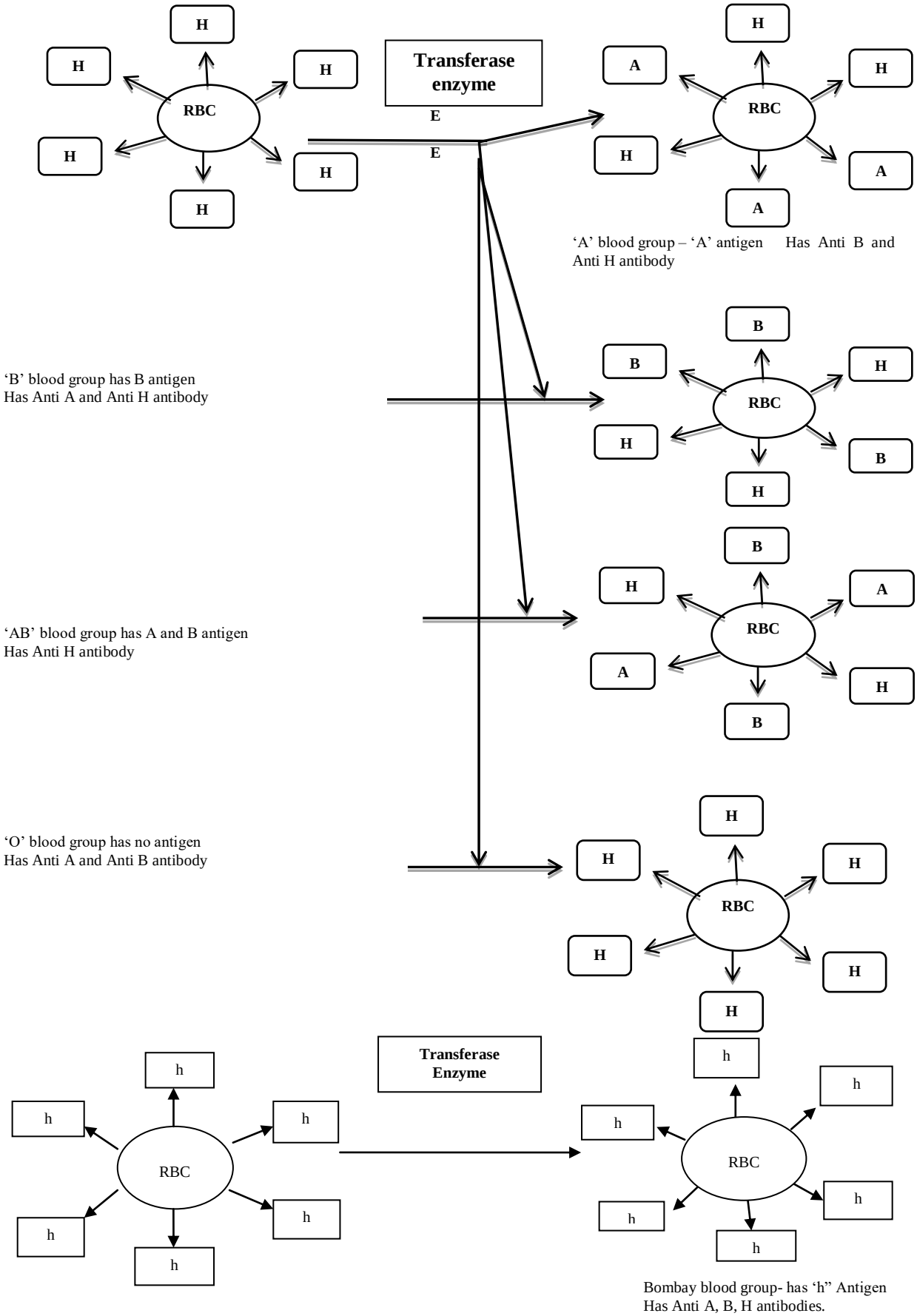

Figure 1. Diagramatic representation of the ABO and the Bombay Blood Groups

But if an individual doesn't have the "H" antigen but has the Recessive "h" antigen on its cell surface; then such individuals though they may have the Transferase Enzyme the antigen won't be converted into "A,B, AB,O" blood groups. Such individual will rather develop antibodies against "A, B" antigens to protect themselves. The probable reason for this exception is due to the production of an inactivated enzyme which is incapable of producing H antigen.

EPIDEMIOLOGY

When Bombay blood group is misdiagnosed, fatal hemolytic transfusion reactions occur It is one of the rarest blood groups, present in about 0.0004% (0.4 million) in the human population. In India, the incidence is 1 in every 7,600 population [(8)] but, while latest statistics by Suraci et al. [(9)] stated that this type of blood group is found in Southeast Asia. The incidence in this region is 1/10,000 and in Caucasians 1/ 2,50,000 cases. A high level of consanguinity presents among the parents of the Bombay phenotype.

This rare blood group is commonly seen in the tribal population of India; most commonly, in Maharastra, Odisha, Karnataka, Andhra Pradesh and Tamil.

BIOCHEMISTRY OF BLOOD

In Homo Sapiens, both the parents contribute to the formation of a child's blood group. The alleles which contribute to this are O, A and B. Thus, to know the blood type of a child we need to know the Phenotype and the Genotype of the Couple.

Phenotype: This is the outward physical manifestation of an individual. It is an organism's ACTUAL observed properties such as morphology, development or behaviour. [(3)] This results from the expression of an organism's genes as well as the influence of environmental factors and the interaction between the two. Thus,

Phenotype = Genotype + Environmental Factors.

Genotype: According to Wikipedia. [(10,11)] it is the genetic makeup of an individual. It is an organism's full hereditary information. It determines how much an individual is different within a group of individuals. So, in Genotype we try to identify what combination of genes the individual actually has. Thus, in an organism, the genotype is the major influencing factor in the development of its phenotype.

Example:-If an individual has a genotype of Aa type; it means

A - Dominant Genotype while a- Recessive Genotype.

BOMBAY BLOOD GROUP GENOTYPE-PHENOTYPE DISTRIBUTION

In blood groups, the "H" Antigen is the precursor of A and B Antigens. This is the dominant genotype whereas the "h" antigen is the recessive genotype. Individuals with A and B blood groups have two types of antigen on their cell surface. [(8)] It is similar to like building two storey building on the cell surface of the RBC's. The first storey consist of the "H" antigen while the second storey in the presence of Transferase Enzyme either contains "A", "B" or the combination of both respectively. The second storey represents the blood group which the individual has.

In individual with "O" blood group, they do have only one storey building where they have only the "H" antigen on their cell surface. They do not have a second storey expressing any allele as they lack the Tranfersase Enzyme. In individuals, with Bombay Blood Group they express the recessive form of the "H" antigen that is the "h" antigen on their cell surface for which they can not express any other allele of either A or B even in the presence of the Transferase enzyme. [(12)]

Thus, individuals with "O" blood group and the "Bombay Blood" group do look similar phenotypically as both of them do not have any antigen of A, or B on their cell surface. This allows the health professionals to miss the Bombay Blood

group cases considering them as "O" blood groups. The difference can only be identified when we assess theses individuals based on their genotype where the "O" blood group has the dominant "H" antigen while the "Bombay Blood" group has the recessive 'h" antigen.

Example:-

Child looks like having O blood group But, actually Child has the Bombay Blood Group

Figure 2: Genotype- Phenotype variation in Bombay blood group (Source: O'Neill,2012)

CLINICAL MANIFESTATIONS:-

Patients with Bombay Blood Group are generally asymptomatic. As they do not have any antigen on their cell surface, such individuals can easily donate blood to any other individual of the ABO blood group system unless some other blood factor genes such as Rhesus factor is incompatible. But, the challenge arises in case these individuals require blood transfusions. In such cases, these individuals develop severe hemolytic reactions if they receive blood from other blood group individuals including O blood group. These individuals have antibodies against A,B, and H antigens; so they can receive blood ONLY from individuals who have the Bombay Blood group which is a rare commodity.

MANAGEMENT:-

Bombay Blood group; being a rare blood group and its prevalence being more in India; management for such individuals is very essential. [(4)]

- Blood banks need to develop Cryopreservation facilities so as to store Blood group packets.
- The blood bank of each hospital can maintain a register of the Bombay blood group patients and donors to such patients with their complete address.
- Regular camps need to be conducted to identify individuals with the rare blood group in the nearby community.
- There should be proper communication among the various Blood banks at the District and State level for such a rare blood donor unit in times of need.
- There should be regular screening of the nearby relatives of the Bombay Blood group individual so as to identify a new one.
- Because for an individual to be Bombay Blood group, both the parents need to carry the recessive "h" antigen to transmit it to their children; so, the prevalence of having a Bombay Blood group increases in closed off communities where consanguineous marriage is very common. Thus, proper screening among such family's needs to be done.

NURSING MANAGEMENT

Blood is a live human tissue which saves lives and improves the quality of life in a wide range of clinical conditions. It is considered as a drug by the Drug and Cosmetic Act of India.

Safety blood practices are a big threat which exists in almost all hospitals of India. Correct transfusion practices is contributed not only by following precautions in the blood centre starting from

the collection till the supply of safe blood but equally important vital is the contribution of the nursing personnel involved in transfusion process. Thus, as nurses we need to be knowledgeable and vigilant regarding the various blood types and ensure safety of the blood transfusion practices.

CONCLUSION

Bombay Blood group ; being a rare blood group serves to emphasize the fact that proper blood grouping and cross matching are so vital elements to ensure safe blood transfusions to such individuals. So, as nurses, it is necessary to enlighten our knowledge and be aware enough to identify the Bombay blood groups and prevent undue blood transfusion reactions. Thus," **blood transfusions will be a saviour to our life and not damage to our lives."**

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